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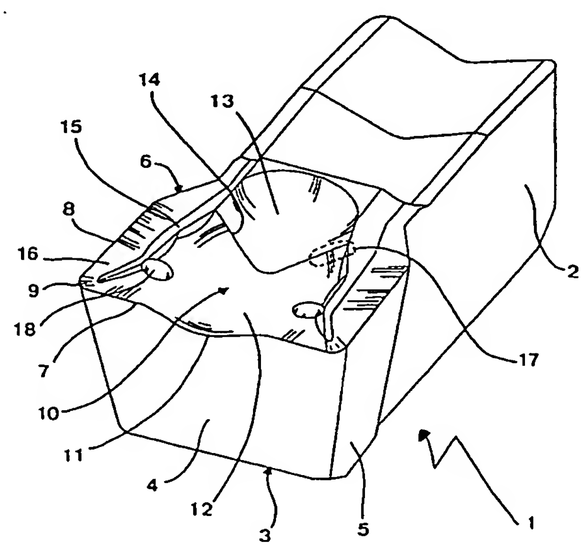
(54) Cutting insert for grooving and for the widening of grooves

(57) A cutting insert for grooving operations comprises a shaft part (2) and a cutting head, the cutting head comprising a top side, a bottom side and relief sides (4, 5, 6) extending between these two sides. The break line of the top side with the front relief side (4) constitutes the main cutting edge and the break lines of the top side with the lateral relief sides (5) constitute side cutting edges (8). The top side has two ridges (15) which extend mainly in the longitudinal direction, a chipbreaker pit (10) between said ridges, which pit comprises two partly overlapping pits (12, 13). A break line (14) or a radius transition extends between the two pits and adjoins at its ends, in connection with two squeezing points or portions (17), the two ridges (15). The chipbreaker pit intersects the main cutting edge (7) so that a curved, depressed cutting edge portion (11) is formed along the main cutting edge. Two burls (18) are located between said break line (14) and main cutting edge (7), either burl adjoining the inner side of the appurtenant ridge (15).

This geometry has resulted in a cutting insert that is perfectly suited for facegrooving, also of the type where not the whole length of the main cutting edge is utilized.

FIG. 1



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Description

The present invention relates to a cutting insert for grooving operations according to claim 1. In particular, the insert according to the invention is suited for face-grooving, although it may also be used for different grooving operations, and also for axial and radial longitudinal turning.

For such machining, the chip breaking and the chip shape are usually of decisive importance for an undisturbed production. Modern, high-productive machines have very high requirements on a good chip conveyance. Long, uncontrollable chips may · easily cause breakdowns and cassations. Therefore, a high degree of attention must be paid to the chip control and to a large extent this steers the design of the tools.

Cutting inserts for grooving operations and cutting-off are ususally clamped in a holder that is of the blade type so that it may be accomodated in the machined groove. The term "holder of the blade type" is intended to also comprise slotting cutters. Such inserts are for instance known from US-A-4 778 311, US-A-4 992 008, US-A-5 135 336 and US-A-5 423 639. In order to make possible facegrooving, by which circle-shaped grooves are formed, it is known to use a curved blade holder, in order to enable its insertion into the circle-shaped groove, see for instance EP-A-416 854. If one then wants to widen the groove, so that it gets a width that exceeds the width of the insert, the grooving opearation has to be repeated with a smaller or a larger groove diameter than that of the first-turned groove. When doing this, the widths of the second, third up to the n^{th} groove have to overlap somewhat with the width of the previous groove, since no material may be left between two consecutive groovings. This involves that the cutting edge is not fully utilized, but only a certain part of it comes into operative engagement with the workpiece.

It has turned out that hitherto known cutting inserts for facegrooving in best case function satisfactorily only when the whole cutting edge is working. If, e.g., half the cutting edge, or only a fourth of it, is working, the chips are not broken sufficiently and the chip control becomes inferior, whereby chip jamming and in worst case a chip breakdown arises. In particular for cutting widths which correspond to less than a fourth of the length of the cutting edge, there is no insert that offers a good chip control for facegrooving.

Thus, a first object of the present invention is to provide a cutting insert that is well suited for repeated, overlapping facegrooving.

Another object of the present invention is to provide an insert that functions well also when only a part of the cutting edge is in engagement.

Still another object of the present invention is to provide an insert that may also be used for longitudinal turning, in particular external turning on the bottom surface of a widened groove.

Yet another object of the present invention is to provide an insert that in a reliable way manages to make the first groove, at which normally a long, unbroken chip is formed.

These and further objects have been attained by shaping a cutting insert for grooving operations with the features as defined in the characterizing clause of claim 1.

For illustrative but non limiting purposes, a preferred embodiment of the invention will now be further described with reference to the appended drawings. These are herewith briefly presented:

Figure 1 shows a cutting insert according to the invention in a perspective view, obliquely from above.

Figure 2 shows a cutting insert according to the invention in a side view.

Figure 3 shows the same cutting insert as Fig 2, straight from the front.

Figure 4 shows the same cutting insert as Fig 2, straight from above.

Figure 5 shows the cross-section A-A in Fig 4.

Figure 6 shows the cross-section B-B in Fig 4.

In Fig 1, the cutting insert according to the invention is generally designated by reference numeral 1. It is made of a suitable hard material, such as cemented carbide. The geometry according to the invention has turned out to give a particularly long life, with maintained good chip control, when the cemented carbide contains 5 to 9 % by weight of cobalt, preferably 5 to 8 % by weight, a sum of TiC + TaC + NbC of between 0 and 10 % b.w., and the rest WC, including naturally occurring impurities. Further, it may be advantageous that a small amount of the cubic tungsten carbide is replaced by carbonitride (0,1 - 0,3 % b.w. of nitrogen in the sintered cemented carbide). The grain size of the tungsten carbide is suitably between 1,8 and 3,2 µm. Furthermore, the cemented carbide is suitably coated by PVD or CVD ("Physical Vapour Deposition" or "Chemical Vapour Deposition"), until a coating thickness of between 3 and 15 µm is obtained.

The cutting insert comprises a shaft part 2 for clamping in a suitable holder of the blade type, such as the one disclosed in US-A-4 801 224. The operative cutting head of the insert comprises a top side, a bottom side 3 which is common for the whole insert, a front relief side 4, two lateral relief sides 5 and two rear relief sides 6. In order to give an adequate clearance, these relief sides are angled to the vertical, so that they form an acute angle to the top side and an obtuse angle to the bottom side. The relief angle α may be about 3 and 15°.

Cutting edges are present between the break lines between the relief sides and the top side, namely a front main cutting edge 7, side cutting edges 8, and corner cutting edges 9 at the rounded transitions between sides 4 and 5. Centrally on the top side of the cutting head there is formed a chipforming or chipbreaking pit, recess or cavity 10, which intersects the main cutting edge 7, so that the latter, in its middle portion, obtains a curved, depressed cutting edge portion 11. In turn, the chip-

breaking pit 10 is divided into a front portion 12, and a rear pit portion 13 superposed with the front portion, the bottom of the portion 13 being located higher than the bottom of the front pit portion 12. The transition between these two pit portions consists either of an intersection or break line 14 or a corresponding radius transition. The intersection line is formed as a substantially isosceles tip that points towards the main cutting edge. Along the opposite sides of the pits in the longitudinal direction of the cutting insert are provided two ridges, which extend in the form of two fingers from the shaft part 2 to the proximity of the two corner cutting edges 9, however not the whole way to said cutting edge. Between a ridge 15 and an adjacent cutting edge 8 extends the primary land 16, which preferably is somewhat positive, for instance between +3 and +15°. Further, said ridges are preferably located on the same height as or somewhat higher than the plane defined by the side cutting edges 8. In the regions around the contact point between the intersection line 14 and the ridge 15, and a bit along said break line, there is a squeezing, clamping, bending and/or pressing "squeezing portion" or "squeezing point" 17, which contributes to the squeezing and curving of the chip in its longitudinal direction, particularly at the first grooving operation, when the whole cutting edge is in engagement. Thereby, the distance between the two squeezing portions is preferably shorter than the length of the curved, depressed cutting edge 11. By "the length of the cutting edge 11" is intended the length of the horizontal projection between the two inversion points of the curves at either side of said cutting edge portion.

Adjacent to, or in the immediate proximity of either inwardly facing side of the ridges, between the intersection line 14 and the main cutting edge 7, there is arranged a burl 18, which suitably is on equal height with or somewhat below the plane defined by the side cutting edges 8 and the two straight side portions of the main cutting edge.

The combination of an intercepted main cutting edge 7, burls 18 and two squeezing points 17 has resulted in a diversally usable and polyvalent cutting insert. When grooving, particularly when facegrooving, the combination of the intercepted edge, the burls and the squeezing points contributes to a good chip control, also when not the whole main cutting edge is in engagement. Even turning widths of < ¼ of the width of the cutting insert gives surprisingly good chip control. At small turning widths of < ¼ also the tips of the ridges 15 work as chipbreaking and chip-deviating protrusions. At longitudinal turning with small cutting depths, e.g., a cutting depth corresponding to < ¼ of the cutting width, a longer portion of the outer side of the ridge functions as a chipbreaker.

Claims

1. A cutting insert, preferentially for grooving operations in metallic workpieces, comprising a shaft part (2) and a cutting head, the cutting head including a top side, a bottom side and relief surfaces (4, 5, 6) extending between these two sides, the intersection line of the top side with the front relief side (4) constituting a main cutting edge and the intersection lines of the top side with the lateral relief sides (5) constituting side cutting edges (8), *characterized in that* the top side has two ridges (15) extending mainly in the longitudinal direction, a chipbreaker pit or cavity (10) between said ridges, which pit comprises two partly overlapping pits (12, 13), a break or intersection line (14) or a radius transition extending between the two pits and at its ends adjoining, in connection with two squeezing points or portions (17), the two ridges (15), the chipbreaker pit intersecting the main cutting edge (7), so that a curved, depressed cutting edge portion (11) is formed along the main cutting edge, and two burls (18) situated between said break line (14) and main cutting edge (7), either burl adjoining or being in the near proximity of the inner side of either ridge (15).

2. Cutting insert according to claim 1, wherein the burls (18) are on equal height as or below the plane defined by the side cutting edges (8) and the straight side portions of the main cutting edge.

3. Cutting insert according to claim 1 or 2, wherein the end portions of the two ridges (15) are angled relative to the remainder of the ridge in the direction of the corner cutting edges (9) of the cutting insert.

4. Cutting insert according to any of the preceding claims, wherein the bottom of the front, cutting-edge-intersecting pit (12) is located lower than the bottom of the cutting-edge-distal, second pit (13).

5. Cutting insert according to any of the preceding claims, wherein the two ridges (15) are in equal height with or higher than the plane defined by the side cutting edges (8) and the straight side portions of the main cutting edge.

6. Cutting insert according to any of the preceding claims, wherein the distance between the two squeezing points or portions is shorter than the length of the curved, depressed portion (11) of the cutting edge.

FIG. 1

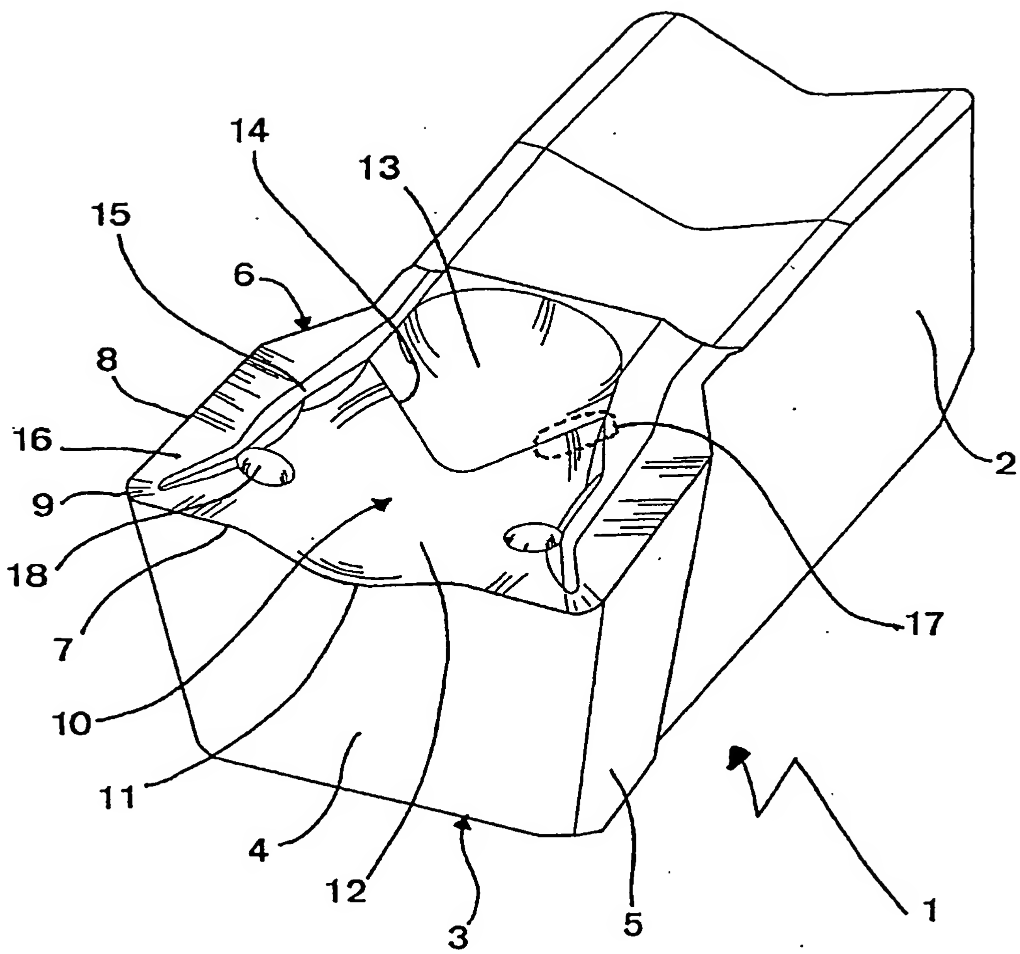
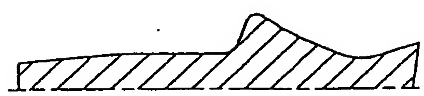


FIG. 5



Section A-A

FIG. 2

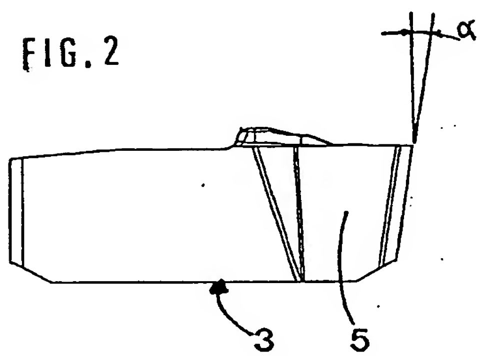


FIG. 3

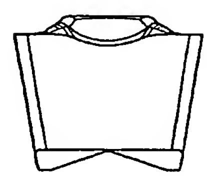


FIG. 4

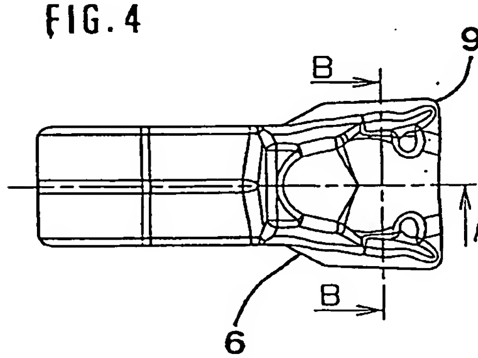


FIG. 6

Section B-B

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 85 0195

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 568 512 (SANDVIK AB) 3 November 1993 * column 3, line 19 - line 41; figure 1 *	1	B23B27/04
A	EP-A-0 257 002 (SANDVIK AB) 24 February 1988 * column 1, line 15 - line 19; figures 1-3 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B23B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 February 1997	Rambaud, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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